

no 11 I.

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Papad March 4<sup>th</sup>

1824

W. S. H.

Dear.

Dissertation

On

Tetanus

By Levi Denz

Maryland.

October. 30<sup>th</sup>. 1823.

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# Tetanus

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I enter with some degree of diffidence on the consideration and treatment of this most formidable and frequently, ~~X~~ mortal disease. It has been distinguished by practical writers into several species, to wit, Opisthotonos, when all the muscles of the neck and spine are affected with rigidity, and the body is drawn violently backwards, and Emprosthotonos, when by similar spasms and rigidity, the head and body is drawn forwards; when the muscles of the lower jaw become rigidly contracted so that the teeth are firmly closed together, it is termed Trismus or Locked jaw. The disease has still put on a different form from any of those above mentioned; The spasms have been sometimes confined to one side of the body only, and which bend it strongly to that side: This is what has been called by Sauvages the Tetanus Lateralis, and Dr. Cullen observes it has by some writers been called Pleurosthotonos. Another variety, or modification of this disease, described by Dr. Caldwell, consists in its assumption of an intermitting character, the spasms ceased to be troublesome about twelve o'clock each night,

The first of these is the fact that the  
country is now a very fertile one  
and that the soil is very rich and  
productive. The second is the fact  
that the climate is very healthy and  
that the air is very pure. The third  
is the fact that the water is very  
pure and that the food is very  
healthy. The fourth is the fact that  
the people are very happy and  
that the country is very peaceful.  
The fifth is the fact that the  
country is very beautiful and that  
the scenery is very lovely. The sixth  
is the fact that the country is very  
large and that the population is very  
large. The seventh is the fact that  
the country is very rich and that the  
people are very wealthy. The eighth  
is the fact that the country is very  
free and that the people are very  
liberal. The ninth is the fact that  
the country is very strong and that  
the people are very brave. The tenth  
is the fact that the country is very  
wise and that the people are very  
kind. The eleventh is the fact that  
the country is very good and that  
the people are very honest. The  
twelfth is the fact that the country  
is very true and that the people are  
very loyal. The thirteenth is the  
fact that the country is very just and  
that the people are very fair. The  
fourteenth is the fact that the country  
is very kind and that the people are  
very gentle. The fifteenth is the  
fact that the country is very brave and  
that the people are very strong. The  
sixteenth is the fact that the country  
is very wise and that the people are  
very kind. The seventeenth is the  
fact that the country is very good and  
that the people are very honest. The  
eighteenth is the fact that the country  
is very true and that the people are  
very loyal. The nineteenth is the  
fact that the country is very just and  
that the people are very fair. The  
twentieth is the fact that the country  
is very kind and that the people are  
very gentle. The twenty-first is the  
fact that the country is very brave and  
that the people are very strong. The  
twenty-second is the fact that the  
country is very wise and that the  
people are very kind. The twenty-  
third is the fact that the country is  
very good and that the people are  
very honest. The twenty-fourth is  
the fact that the country is very true  
and that the people are very loyal.  
The twenty-fifth is the fact that  
the country is very just and that the  
people are very fair. The twenty-sixth  
is the fact that the country is very  
kind and that the people are very  
gentle. The twenty-seventh is the  
fact that the country is very brave  
and that the people are very strong.  
The twenty-eighth is the fact that  
the country is very wise and that the  
people are very kind. The twenty-  
ninth is the fact that the country is  
very good and that the people are  
very honest. The thirtieth is the  
fact that the country is very true and  
that the people are very loyal.

night, and not return until near twelve the next day.  
 The above division leads to no variety of practical treat-  
 ment, for the several terms above mentioned, denote, and  
 are applicable only to different degrees of one and the  
 same disease. It is divided into *Ideopathic* and *Sympto-*  
*matic*: The first is produced by general causes, as checked  
 perspiration, and exposure to cold and moisture; it is also  
 excited by the vicissitudes of heat and cold, by exposure  
 to marsh miasmata, and by exhaustion from over exer-  
 tion. The second results from wounds and various irritants,  
 as the partial laceration, or even the puncture of a nerve  
 or tendon, gunshot wounds and various surgical operations,  
 particularly amputations; and it is truly remarkable that  
 a very trifling injury or puncture by a nail, splinter  
 of wood, or bits of glass, about the feet, hands, or fingers,  
 will often produce tetanus when it is least expected, while  
 at other times wounds of a more formidable nature will  
 have no such effect. It is also produced by the irrita-  
 tion of worms, by the acid matter of dysentery or other  
 sores, by the bites of venomous reptiles, by powerful  
 stimuli



stimuli acting on the stomach, as the stramonium, cam-  
 phor, hemlock, ardent spirits in excess, by constipation  
 of the bowels, and lastly, from a large collection of  
 cherry stones in the rectum. This horrid complaint,  
 may occur from certain causes in every climate that  
 we are acquainted with; but it is more frequently met  
 with in warm climates, and most frequently in the  
 warmest season of such climates. It affects all ages,  
 sexes, temperaments, and constitutions, but the male  
 sex more frequently than the female, and those  
 of a robust and vigorous constitution, oftener than those  
 of a weak habit. When the disease takes place in  
 consequence of cold or exposure, the tetanic symptoms  
 often make their appearance very soon. But whenever  
 it is produced by a wound, puncture, or any other, external  
 cause, the disease does not come on for many days af-  
 ter the lesion has happened, very often when there  
 is neither pain nor uneasiness remaining in the woun-  
 ded part, and frequently the tetanic symptoms appear  
 after the wound has entirely healed up: The disease  
 sometimes





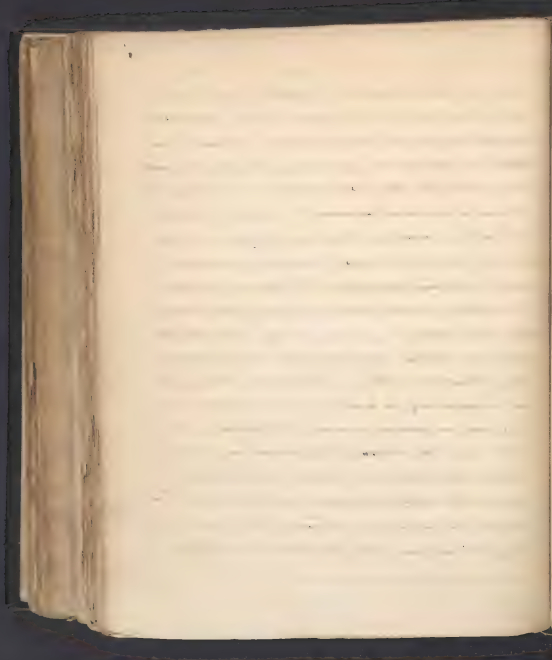
sometimes comes on suddenly to a violent degree, but more generally it approaches by slow degrees to its violent state. A slight stiffness is at first perceived about the back part of the neck, with general lassitude, and the motion of the head becomes difficult and painful, as the rigidity of the neck becomes more considerable, a sense of uneasiness is felt about the root of the tongue, which by degrees produces a difficulty or inability of swallowing; there is considerable pain at the end of the sternum shooting into the back, when this pain arises, all the muscles of the neck, and particularly, those of the back part of it, are immediately affected with spasm, pulling the head strongly backwards; at the same time the muscles of the lower jaw become rigidly contracted so that the teeth are firmly closed together; this is what has been named, as I have before mentioned, Trismus or Locked-jaw, and is often the principle part of the disease; When the disease has advanced thus far, the pain at the bottom of the sternum returns very frequently; and with it, the spasms of the hind neck, and lower jaw, are renewed with violence, and much pain. As the disease



disease thus proceeds, a greater number of muscles come to be af-  
 fected with spasms. After those of the neck those along the sides  
 of the spine become affected bending the trunk of the body slump-  
 ing backwards, in such a manner that the patient is supported  
 by his head and heels, the spine forming an arch, and this  
 is what has been named opisthotonos. When the antagonistic  
 muscles of the whole body are so contracted that the patient  
 can bend himself in no direction, but remains stiff in one  
 position the disease is shrilly called Tetanus. During the whole  
 course of the disease, the abdominal muscles are violently affec-  
 ted with spasm, so that the belly is strongly retracted, and  
 feels remarkably tense and hard; at the same time the same  
 little affected before, are now rigidly extended. The whole of the  
 muscles belonging to them being affected with spasms, except  
 those that move the fingers, which often to the last retain some  
 mobility; The tongue also long retains its mobility, but as  
 length becomes affected with spasm, which attacking certain  
 of its muscles only, often thrusts it out violently between  
 the teeth; at the height of the disease every organ of volun-  
 tary motion suffers in a greater or less degree. The eyes are  
 hollow



hollow rigid and immovable the forehead is wrinkled the  
 nose is drawn up, and the cheeks are drawn backwards to-  
 wards the ears, and the whole countenance is hideously dis-  
 torted, and expresses the most violent grinning; the strength  
 becomes exhausted, the pulse irregular respiration difficult,  
 and universal convulsions supervene to terminate a most mis-  
 erable state of existence. The spasms are every where atten-  
 ded with most violent pains, and generally continue for a  
 minute or two, and often longer, and return at intervals of  
 ten or fifteen minutes, sometimes a much shorter time, and  
 that often without any evident exciting cause: But appar-  
 ently such exciting causes frequently occur, for almost  
 every attempt to motion, as attempting a change of pos-  
 ture, endeavouring to swallow, and even to speak, some-  
 times gives an apparent renewal of the spasms over the  
 whole body. The attacks of this disease are generally  
 attended with some febrile action: When the spasms are  
 general and violent, the pulse is contracted, hurried, and  
 irregular, the respiration is hurried in like manner, but  
 during the ravishment both the pulse, and respiration  
 usual.



usually return to their natural state; The heat of the body, is not commonly increased, the face is generally pale and covered with a cold sweat, and very often the extremities are cold, with a cold sweat over the whole body). When however the spasms are frequent and violent, the pulse is sometimes more full, and frequent than natural, the face is flushed, and a warm sweat is forced out over the whole body. Dr. Caldwell states that, at the commencement of the disease, the pulse is oftentimes full and frequent, tense and strong; blood drawn at this time, throws up a covering of coagulating lymph. In this disease the head is seldom affected with delirium, or even confusion of thought, till the last stage of it; when by the repeated shocks, of a violent distemper, every function of the system is greatly disordered. It is no less extraordinary, that in this violent disease, the natural functions are not either immediately or considerably affected. Vomiting sometimes, but very rarely appears in the early stage of the disease, the appetite of hunger remains through the whole course of the disease, and what food happens to be taken down, seems





seems to be regularly enough digested: The excretions are  
 sometimes affected, the urine is sometimes suppressed, voided  
 with difficulty and pain, the belly is costive, but this I  
 suspect is owing more to the effect of treatment, than to  
 the nature of the disease: It is not unusual for a military  
 eruption to appear in the course of the disease, but this  
 I believe, denotes neither safety; nor danger and has  
 no effect in changing the course of the disease. The  
 disease formerly, very generally proved fatal, but as the  
disease has become more and more known, a more proper  
 method of treatment has perhaps been adopted (but the  
 practice now is not unanimous) and many now recover, where  
 they formerly died. With regard to the duration of  
 the disease when it proves fatal, it generally carries off the  
 patient about the fourth day, sometimes he lingers for  
 ten days, or even a fortnight, and cases have occurred,  
 where the patient is suddenly taken off in forty eight  
 hours, and the younger the subject, the more rapid the  
 disease. Accordingly, as the disease often proves fatal  
 before the fourth day, and when the patient has  
 passed



passed this period, he may be supposed to be in greater safety, and in general the disease is ~~safe~~, the longer it has continued; It is however to be particularly observed that, even for many days after the fourth day the disease continues to be dangerous, and even after some abatement of its force, it is ready to recur again, with its former violence and danger: The disease never admits of any sudden, or what is called, critical solution, but always recedes by degrees only, and it is often a very considerable length of time, before the symptoms entirely disappear. When tetanic affections arise in consequence of a wound, puncture, or laceration, or is the consequence of amputation or gunshot wounds, we are told, that the disease usually proves fatal; but this I very much doubt, for from observation, and from high authority, I can say the disease does not so very generally prove fatal, when it is the consequence of any organic lesion, but on the contrary, many more recover than die. But when it arises in consequence of cold, it has been regarded to be less dangerous, and is more easy to manage. Dr. Lorry has remarked, that if in an adult,   
the



the pulse by the fourth or fifth day) does not reach 100 or 110 beats in a minute, he believes the patient almost always recovers; if on the other hand the pulse, on the first day is 120 or more in a minute, few instances he apprehends will be found in which he will not recover. These observations respecting the acceleration of the pulse, has not, I believe, been confirmed by any other practitioners. In dissections, some slight effusions have been found within the cranium, but in very few instances; In some cases however, the blood is not found coagulated but fluid, resembling the blood of animals killed with lightning: It is also stated by Baron Larrey that in his examinations of bodies of persons who have died of tetanus, he found the Pharynx and Oesophagus much contracted, and their internal membranes red, inflamed, and covered with a viscid, reddish mucus. Others (as described by Dr Robert Thomas) have discovered the intestines much inflamed and in a few instances a yellow watery fluid of a peculiar offensive smell, covering their internal surface; but many perhaps would not rest, satisfied



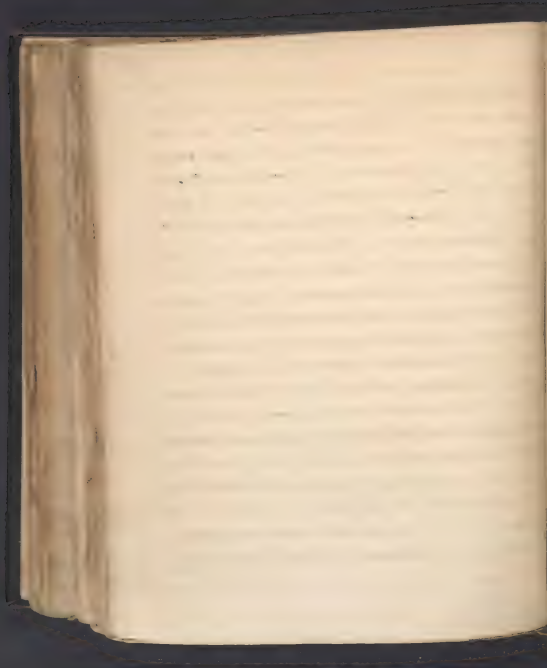
satisfied here, thinking that the inflammation was not primary, but only the consequence, of the pressure, of the abdominal muscles which contract so violently in this disease. The inflammation in Tetanus is however different from that observed in enteritis for in the former there are no adhesions, nor is there any formation of matter ever found. An inflamed nerve has been supposed to be the cause of this disease, but examinations have been made, from the place of injury, to their central termination, and no inflammation could be found. Therefore this conjecture must now be entirely rejected.

I now come to consider the treatment, of this most lamentable and dreadful disease; although this disease has been considered generally fatal, when it arises in consequence of wounds, but still we should never refuse to extend our aid, and endeavour to afford temporary relief or alleviate the sufferings of such a miserable state of existence. Medical experience has not as yet been sufficiently to find out any decisive or unanimous plan

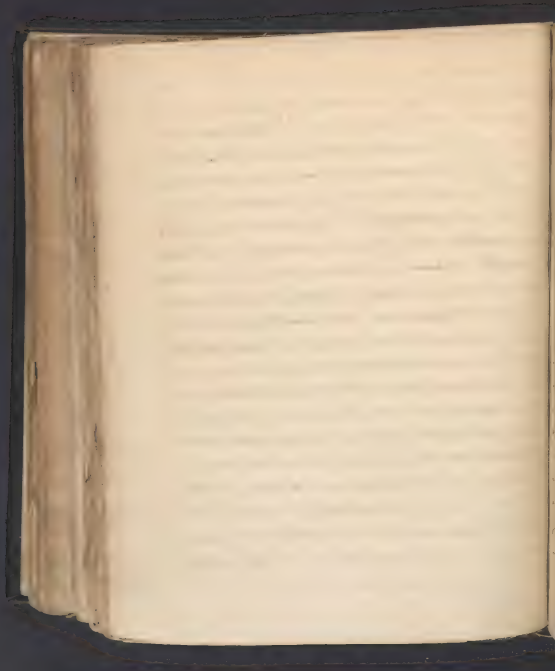




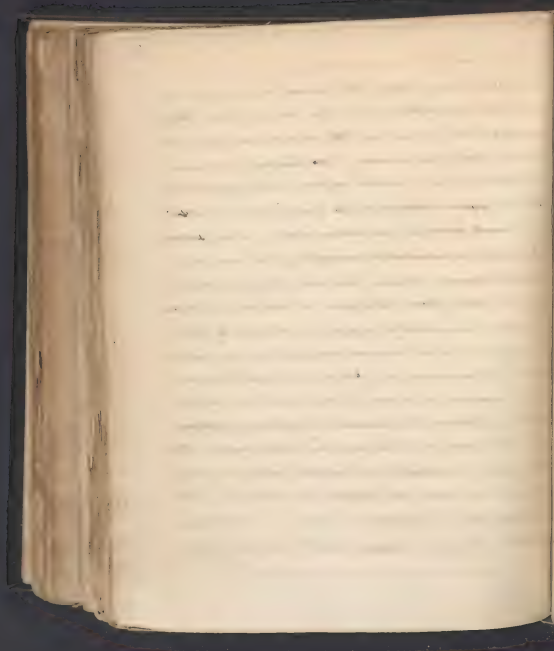
plan of treating this disease; various remedies have been used, and recommended by different medical men; but as to myself, who am yet a tyro in the art of medicine, but from some experience and observation only, I can with some degree of confidence, recommend the opiate plan of treatment. On being applied to for advice, we should endeavour in the first place to find out the cause which has given rise to the disease. If supposed to proceed from a wound, we should carefully examine the injured part, and ~~extract~~ as quick as possible, any extraneous body that may have lodged therein, taking care at the same time to dilate the wound freely, and apply stimulating applications to the part, as Laudanum or the Oil of Turpentine, so as to produce inflammation and suppuration; If the partial division of a nerve is supposed to be the cause of the disease, we should divide it completely by a free incision. Baron Larrey has recommended the application of a hot iron in these cases, and promoting suppuration afterwards as speedily as possible by stimulant dressings. Mercurial ointment



ment has been used as a dressing to wounds; Fencilling the wound with lunar caustic, and afterwards covering it with a poultice of bread and milk, with a view to obtain suppuration as soon as possible, has also been used. The above are the external means which are generally used by medical men, and we are informed that they are generally useful: But I should consider it, more as a useless torture, than as a practice of benefit, if delayed until the disease has made its appearance; but nevertheless if there is any extraneous irritant, obvious, it most assuredly should be removed. If the disease should arise from any narcotic stimuli acting on the stomach, I should in the first instance, use an emetic, to throw off the offending cause, if it is the consequence of any solids, or the acid matter of Dysentery, or any other irritant, lodged in intestines, we should first use a cathartic to clear the *primæ viæ* of its irritating contents. Dr. Hamilton considers purgatives, as entitled to the highest confidence in the cure of this disease; they certainly are

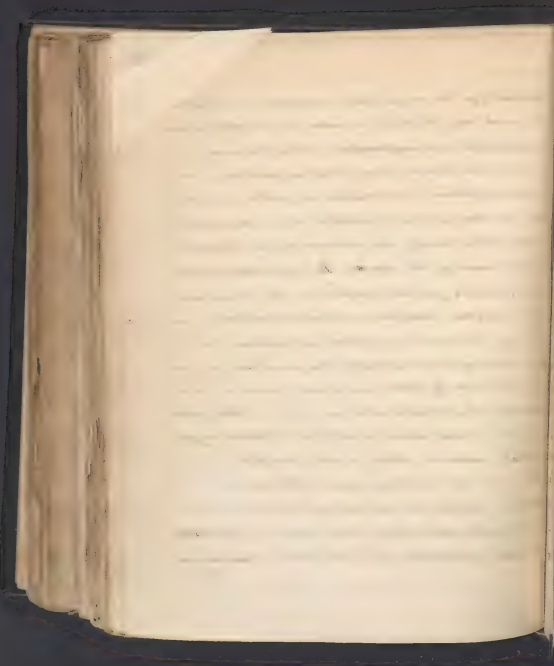


are useful, only where the disease depends on some internal irritation, and only here, so far as they remove the contents of the *prima via*. Where the disease arises from wounds, Barrow Lerrey recommends the limb to be amputated, so soon as the symptoms of *létargie* appear. Experience has taught the medical public, such operations, are seldom, if ever useful: *létargie* furnishes a memorable example of the manner in which diseases change their seat. Radicated of *fièvre*, in the spot, where the injury is received, it afterwards becomes so completely infixed, in other parts, that no impression on its original seat, can have any influence in removing it. When the disease has arisen in consequence of a wound, some as I have before observed, torture the miserable sufferer, by applying red hot irons, &c. to the part, and even amputate the member, on which it is inflicted; Here we might operate in vain, the disease has so changed its ground, that it appears to traverse a sea, in every muscle, and every nerve, and to cure it, we must  
revolutionise



revolutionize the whole habit. A splinter under the finger nail, says Dr. Rush, produces no convulsions, if pain, inflammation, or suppuration follow the accident: But I have the fortune to say, that suppuration, is not a preventative of the disease in question, for I have seen it occur from an amputation of the os femoris, the stump healed kindly, and continued so to do, through the whole course of the disease. No regular plan of treatment, has as yet been adopted in the management of this disease, therefore we should be cautious, in questioning the practice of others, for medicine, which in the hands of high authority has proved successful, has in the hands of other men equally deserving, proved inefficacious, therefore both are right in their reports, and the medical public, is still left to labour, in quest of that medicine, which is most successful.

The warm bath has been recommended as promising essential benefits, but we are informed from numerous trials which have been made, it has disappointed expectations, and has produced mischievous effects.



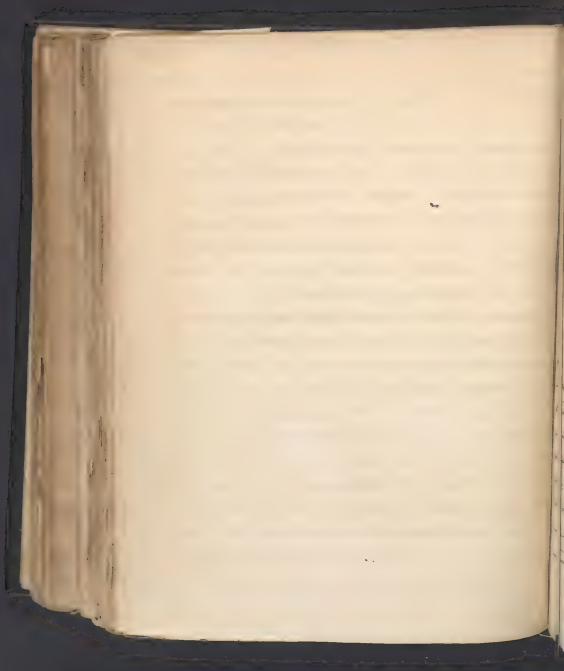


effects: The cold bath has its advocates, the manner in which it is employed, is by pouring, from a considerable height, large quantities of cold water over the patients head and body, after which, he is to be carefully dried and rubbed with a cloth, and put to bed, and a dose of Laudanum given him; This process must be employed every three or four hours, until the intervals of freedom from the attacks of the spasms increase in length, which we are told soon follows and end in a perfect cure.

Dr. Ferdinand Stiller has been successful in the treatment of three or four cases of Tetanus, arising in consequence of wounds, by the use of Fowler's arsenical solution, he administers ten drops, combined with an equal quantity of Laudanum and a large spoonful of common spirits every half hour, when relief is obtained, he diminishes the dose and gradually discontinues it. Here the solution cannot gain the credit of curing the disease, but if it be used alone, and if then succeeds, the discoverer will assuredly be entitled to the praise and gratitude of

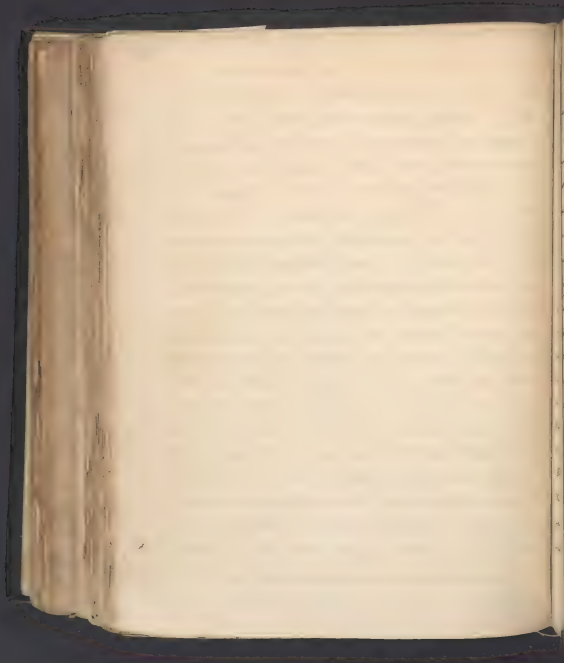


of the public weal. Mercury is used with advantage, and we are informed, if it is resorted to, early in the disease, and pushed to the extent of speedily effecting the mouth, it will undoubtedly be attended with some success. The Barbadoes Tar has been said, in some instances, to effect a cure, but the manner of using it is not known. Dr. Hauber quotes an instance, where the symptoms of the disease were surprisingly mitigated, by an emetico composed of half an ounce of the Spirits of Turpentine combined with eight ounces of the infusion of Lemna; Glysters of Tobacco has also been used with benefit. Electricity is reported, to have been employed in some cases of Tetanus, with a happy result. An alternate internal use of opium and carbonate of Potash, is said to have been employed, in the hospitals of Germany among the wounded soldiers in the late war, with a most happy effect. The effect of opium is considered to be much increased, if also combined with the use of carbonate of Potash. When the disease proceeds from an exposure to cold, although an advocate for

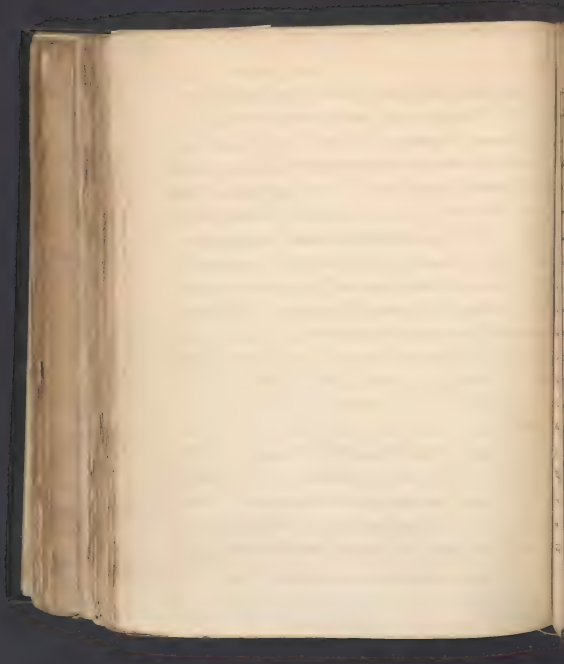


for the opiate plan of treatment, I should think that re-  
 section would be first necessary, for it is here more par-  
 ticularly, that inflammatory symptoms might prevail,  
 and it is well known, that bleeding reduces inflamma-  
 tion, and facilitates the effects of other remedies.

Bark and Wine <sup>are</sup> strongly recommended by Dr. Rush as  
 the most efficacious remedies, which he has employed; again  
 Dr. Rush has succeeded in a case of Tetanus which was produ-  
 ced, by the extraction of two teeth, by the use of wine and Mer-  
 cury. Wine is strongly recommended by Dr. Horeck and Dr. Garri-  
 son gave it, in doses of a wine glass full every hour, and suc-  
 cessfully succeeded in relieving their patients. Great reliance is placed  
 in the use of Opium, Wine, and Mercury; of these we are in-  
 formed, that the two former, retard the progress of the disease  
 preventing exhaustion and death, from the violence of the  
 spasms, until the latter has had time, to eradicate it suc-  
 cessfully, by converting the Tetanic into the mercurial ac-  
 tion, and if the Mercury ~~is~~ administered in such  
 quantities, as to salivate, the Tetanic action will not be  
 removed. Various other medicines have been used, either  
 as

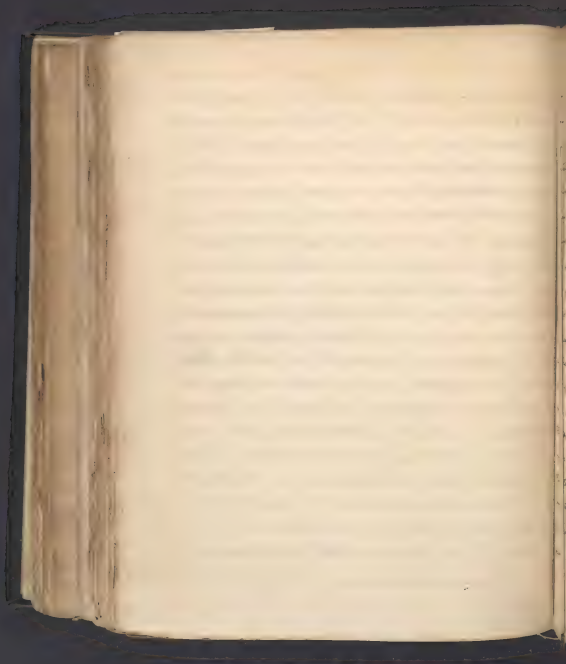


as augmenting the vigour of those means which I have mentioned, or they may have been thought, sufficient of themselves, to eradicate the disease, but I believe they have been considered of minor importance, and by some persons useless. Bark and wine I have seen employed in this disease, but with no effect, and wine I have seen employed alone, with the same unfortunate result. A young man about seventeen years of age, who from some cause, injured one of his thighs, but not so much so, as to be concerned thinking that no serious consequence would result, he continued to go about, the thigh became much swollen and inflamed, which prevented him from using much exertion. He now made use of poultices, after using them for some time, he found the tumefaction and uneasiness still continued, with an inability almost to move the limb, from some unsteady motion he fractured the bone, my Preceptor Dr Thomas Marten was now employed for his relief, he found the report which was made to him, to be correct, the tumefaction was now so great, that nothing could be done except means used to reduce the swelling, after the swelling was abated

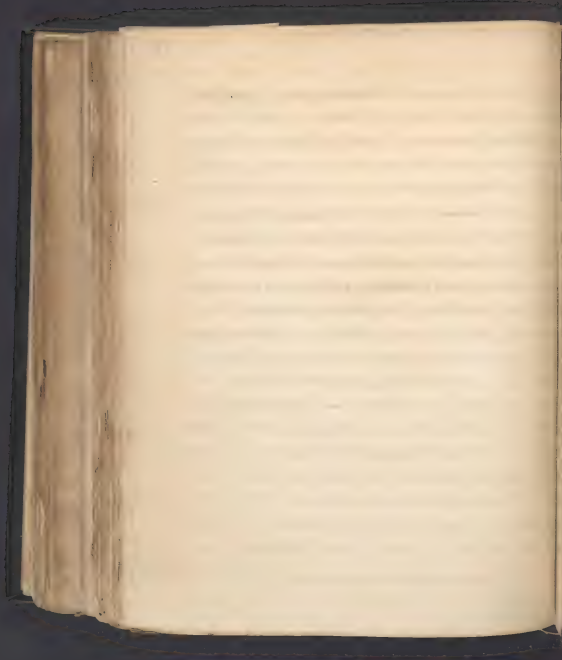




elated in some measure, the fractured bone was resound, and the  
 patient got so much better that he could move the limb of  
 his pleasure; but the young man being restless and tired of  
 confinement, he again from some impudence, fractured the  
 bone a second time, and all our attempts to produce a second re-  
 union, proved abortive, the inflammation and hæmefaction became  
 considerable, and a collection of matter formed, which pointed  
 externally; the integuments broke, and the matter continu-  
 ed to ooze out; the patient continued in this situation for  
 some days, the bone protruded through the integuments, his  
 health now became bad with hectic symptoms, we improv-  
 ed the young man of his situation, and told him the only  
 resort was amputation he at first refused, but finding his  
 health fast declining, he at last consented to an operation;  
 accordingly we had to amputate the thigh, within about  
 five inches of the Hip joint, the flesh appeared not to be heal-  
 thy, the bone looked to be diseased in one small spot, and  
 we were fearful that serious consequences might follow; in tying  
 up the arteries, I found they would not bear any kind of ex-  
 tension, and the only manner that we could confine many



of them was by including a considerable portion of flesh within the ligature; after securing the arteries we dressed the stump in the usual manner. I examined the limb after it was amputated, and found the bone to be completely carious from within, on half inch, below where it was amputated, to the knee joint. The stump went on to heal kindly, and the young man's health, became immediately better, the ligatures came away about the usual time, several days after the coming away of the ligatures a twitching of the muscles of the stump took place, which kept it very often in considerable motion, a few days after this twitching had made its approach, a regular train of tetanic symptoms, began to make their appearance first by an uneasiness and stiffness, of the back part of the neck, the motion of the head, became difficult and painful. The spasms of the disease, could always be forestalled by stretching or subcutaneous, of the muscles of the stump, and at intervals of the attack the stump would be quiet. Here I think we had a complete trial, of the Bark, Wine, and Opium; as the disease made its approach, the patients bowels were evacuated, we then commenced with the use of Bark and wine, which was given regularly



regularly, at short intervals, and in large doses the Saline symptoms still continued without any abatement of symptoms, The Bark and Wine was still continued, The medicine became discordant to the stomach, and finding, that the ravages of the disease, still continued without any abatement whatever, the Bark was relinquished, and Wine alone was used, and after he had taken a considerable quantity, which was given at very short intervals, it became nauseous to his stomach, and he rejected it, The Saline symptoms still continued without any abatement of their force and the poor man apparently sinking under its use; We now without any farther trial, (which was I think very sufficient) commenced with the use of Opium, the patient took one grain every three hours, by gradual means, the quantity was increased, and the time of giving it was lessened to one hour, so that the patient took thirty grains in twenty four hours, we now perceived the disease to give way and by a farther use of the medicine, the symptoms had so much abated, that the dose was ordered to be gradually lessened; The nurse thinking the disease now to be cured, it was lessened too fast, and all



all the alarming symptoms again returned, the Opium was again ordered, to the same full extent, and the symptoms of the disease after a short time began to fade away, the medicine was again ordered, to be gradually discontinued, but by lessening the quantity too fast, the tetanic symptoms again returned, with all their violence, and fortunately, I visited the patient at this period, the attendants had relinquished all hopes of recovery, and had entirely stop'd with the use of his medicine, I was astonished at the idea, for hopes should never be blasted, I immediately asked for the Opium and ordered it to be continued. ~~will not~~ <sup>any</sup> respect to persons, after using it for a short time, the symptoms were a little mitigated, seeing now that the disease was completely under the control of Opium, my Preceptor determined to watch the disease, with more vigilance and not to trust to the integrity of his attendants, as the disease gave way, the Opium was very gradually lessened, and after a period of five weeks, from the commencement of its symptoms the disease was removed,





the stool continued to be kind, through the whole course of the disease; the patient was nourished with a light diet, a piece of soft wood was kept between the teeth, to prevent his injuring his tongue, and his bowels were kept open by the use of clysters. In undertaking the cure of this disease, I should first endeavour to find out the cause, that being removed, I should then apply to the use of opium, and no respect must be paid to the quantity given, but to the effect, if produced, for doses, which under other situations, would prove destructive to life, here prove to be of no benefit.



